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THE ECLIPSED MOON SUNLIT.

BY RICHARD A. PROCTOR.

(*Continued from p.* 307.)

THERE remain some points which apparently confuse even "men who can render a reason"—for most of their views at any rate.

In the first place, to see an object, even in a distorted form it is necessary that we should do more than merely get light from it. Rays starting from each point of an object must be gathered into a focus on the retina of the eye if that point is to be discerned as such; and by the combination of such focal images of the different points of an object there is formed on the retina an image of the object, more or less correct in its proportions. This is true whether the object is looked at directly, or through various media, and whether these be diffuse or formed into particular shapes, as lenses, mirrors, and so forth. And though we need not expect anything like perfect vision in the case of the sun supposed to be seen through the earth's atmosphere from a point on the moon's surface during total eclipse, yet we ought to be able to show that each point of the sun would be visible as such, with suitable focal adjustment of an imagined lunar eye: (the adjustment would be different for different points, and that would prevent distinct vision of the ring-shaped image of the sun as a whole, but any zone for which the eye were adjusted would be visible.)

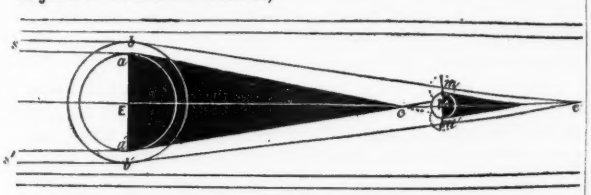

Fig. 2.

Now here comes in what has proved an exasperating difficulty. Some students imagine that c (Fig. 2) is the focus for all rays skirting the earth's atmosphere as at a and a', a different focus somewhere along $c\,c'$ resulting for rays through each layer of the air above the sea-level. And, as an imagined observer at M could not possibly get sunlight proceeding as from a focus at c or c', a vague sort of mystery spreads itself over the whole inquiry. How *can* he get light from those parts of the sun which are obstinately bent on making their rays focus at c or c' or anywhere except at M, where the student supposes that a focus is wanted (which is very far indeed from being the case)?

This difficulty, or rather this bundle of difficulties, has its origin in a double mistake. First there is the idea that an atmosphere like the earth's may be regarded as if it were a spherical shell, part of a spherical lens of some such substance as glass; and secondly there is the idea that a spherical lens—regarded as a whole—has a *focus*. As matters of fact:—First, the different density of the atmosphere at different heights causes it to be as unlike a spherical lens, or a shell of such a lens, in its action, as a concave lens is unlike a convex lens; and secondly, a sphere, though it has a definite focus for rays passing near its centre, has a great number of foci for rays which pass through different parts of it, and these foci are not centrally situated, like the focus for rays traversing the sphere centrally.

The second point does not concern us much, except in so far as it serves to measure the incorrectness of the ideas commonly entertained about the action of a sphere as a lens. But the first is of essential importance.

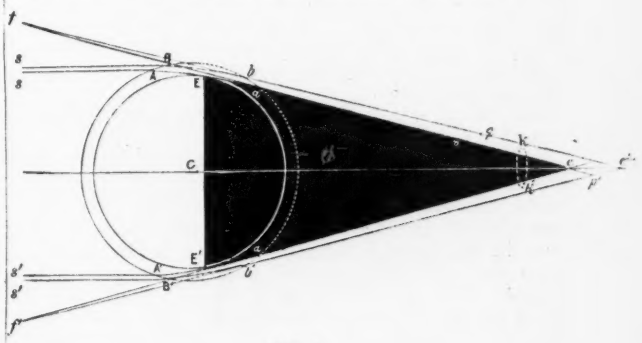

Fig. 4.

Thus, suppose E E', Fig. 4, to represent the earth, S A a c, S' A' a' c the course of two rays from a point on the sun through the air along the curved lines A a, A' a', just grazing the surface of the earth at the opposite points E and E', and crossing at c the prolongation of the line from the point on the sun through C. Let s B b c', s' B' b' c', be two rays from the same point passing above E and E' at the same height and crossing C c produced in c'.

Now, if B b b' B' were a homogeneous sphere, the foci for the rays S A, S' A', s B, s' B', would not be on C c'. The rays S A, s B after refraction might converge to a point as k and the rays S' A', s'B' to a corrresponding point k', the whole set of rays at the same distance from the line C c c' converging to a focal ring as k k'. Even this would be so remote from the common idea (the common mistake) that all these rays converge to some point on C c' as to justify my remark that in the case of the ruddy eclipse question, the ray S A has no more connection (focally considered) with the ray S' A', than the last ray of the setting sun yesterday with the first ray of the rising sun the day after to-morrow.

But under the actual circumstances of the case, the emergent rays a c, b c', do not tend to a focus on *that* side

at all. The ray *b c'* having suffered less deflection than the ray *a c*, these rays, which had already been slightly divergent when they fell on the air at A and B, are now become more divergent, and proceed from a virtual focus situated as at *f*, only much farther away relatively from the earth. Similarly the rays S' A', *s'* B' after refraction along the curved courses A' *a'* and B' *b'*, emerge on the tracks *a' c* and *b' c'*, as from a focus (virtual) at *f'*. Taking all the rays from the given point on the sun, inclined in the same degree as S A, *s* B (or rays between these), and S' A', *s'* B' (or rays between these) to the line from that point to C, *c*, and *c'*, we find a ring of foci, such as *f* and *f'*; (to avoid confusion, the ring is not shown as the ring *k k'* is). In other words the point is transformed into a ring. But of course it would only be seen as a ring to an eye suitably placed on the axial line C *c c'*.) The case corresponds to that of the sun's centre supposed to be centrally behind the earth, in my former treatment of the problem.) Anywhere else within the region into which the rays are deflected, the point would be seen either as one point, or as two points on opposite sides of the sun. Thus to an eye at *p*, one point would be seen as at *f* close to the earth's edge, and no other; to a point at *q* one point would be seen as at *f*, slightly above the earth's surface, and no other; to an eye at *p'*, where the rays *a c*, *b' c'* cross, one point would be seen as at *f* close to the earth's edge, another as at *f'* slightly above the earth's surface, but no more. To an eye at *c* the point would be transformed into a focal ring close to the outline of the earth's disc; while to an eye at *c'* the point would also be transformed into a focal ring, but it would not be quite close to the earth's outline.

This we had already recognised (see my former papers) in another way.

The above explanation shows also in what degree the amount of light received from the sun will be diminished. For in whatever degree the already slightly divergent beam of light *s* B S A is made more divergent at its emergence in the form of the beam *b c' a c*, its illuminating power for any surface exposed to it is correspondingly reduced. But since it may be shown that the apparent area of any small portion of the sun's surface is diminished when thus seen through our air, in precisely the same degree that the area-divergence* of the beams of light from it is increased, it follows that in this case as in all such cases, the intrinsic lustre of the surface is not affected except by absorption.

I incline to think that the fundamental error in Mr. Williams's inquiry into this matter has lain in the supposition that rays undergoing horizontal refraction at the surface of a sphere, that is falling on it tangentially or grazingly, pass in almost as grazingly as they enter, and then suffer total reflection. There is a passage in Brewster's "Optics" which I remember perplexed me very much when I read that work as a boy, in which he speaks of rays under certain conditions being totally reflected inside a sphere and afterwards undergoing repeated reflections and never getting out. I forget the actual wording; but I am inclined to think there was a real mistake on Brewster's part, not misunderstanding on mine. (The passage was only a casual remark.) Anyhow it is certain that no light which can get into a sphere of any substance can possibly suffer total reflection inside the sphere—for the simple reason that it can only get in at an angle not exceeding the critical angle, even if it falls tangentially; and at whatever angle it enters, at the same angle must it emerge.

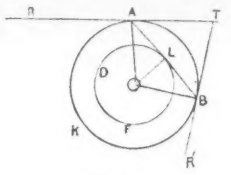

Fig. 5.

Thus if R A, Fig. 5, is a ray incident tangentially on the sphere A B K at A, refracted according to the law of sines* in direction A B, it will emerge tangentially at B in direction B R'. For, producing the tangents R A and R' B to meet at T, it is obvious that the angle B A T is equal to the angle A B T'; and as B A T is the critical angle so also is A B T. The ray then which has got in, will get out again, along tangent B R'. Some light will of course be lost by reflection at B, just as some was lost at A. There always is reflection where there is refraction. But total reflection only occurs beyond the critical angle.

Thus we can always get light through the very edge of a sphere even of flint-glass or diamond. (Any one who doubts can get a sphere of diamond and try, forwarding to me afterwards as a present for pointing this out—a one-inch sphere will do very well). The experiment can be tried with a globular decanter full of water. (*This* need *not* be forwarded to me; but indeed that would follow at once from reflection. With a large globe, as a globular fish-bowl, the eye can even be so set that a distant luminous object—as the sun—would be altered into a ring by tangential refractions (an opaque body filling up the middle of the globe will prevent the direct image of the sun being seen at the same time, as it otherwise would; only the whole ring could not be seen at a single view, forming too large an optical field).

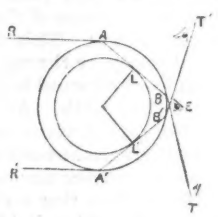

Fig. 6.

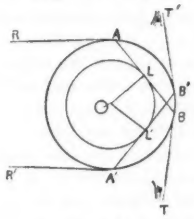

Fig. 7.

Figs. 6, 7, 8, 9 show the course of tangentially incident parallel rays: for water (refractive index 1·33), Fig. 6; glass with refractive index 1·5, Fig. 7; glass with refractive index 2 (very heavy flint-glass) Fig. 8; and air, supposed of uniform density, *in vacuo*, with refractive index (O A : O L) = 1·00028 Fig. 9, only A B ought to be much shorter, being really an arc of only 3° 10′.

An eye placed anywhere along B T in any of these cases will get light tangentially from B, in fact *see* the remote source of light (supposed to be far away on the left) in the direction T B. An eye anywhere along

* As distinguished from the linear divergence.

* There is something to my mind rather clumsy in Brewster's way of dealing with refraction through a sphere. The little circles at incidence and emergence—as I remember them—introduce quite unnecessary complexity. Thus in the above case all we have to do is to describe a circle L D F with radius O L such, that ratio O A : O L = μ : 1 (μ being the refractive index) and to draw a chord A L B tangent to this circle: A B is the direction in which the ray R A is refracted, &c.

B′ T′ will see the object in the direction T′ B.′ In the case of a water-globe, an eye set at the place where B T, B′ T′ cross, would see the object converted into a ring of light all round the apparent edge of the sphere, if the angle B E B′ were not larger than the angular range of the optical field. (A fly's multiple eye set at E would so see the remote source of light.)

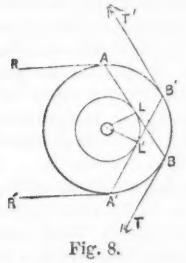

Fig. 8.

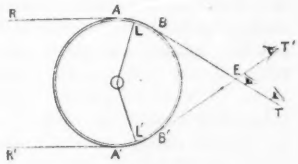

Fig. 9.*

Of course in the case illustrated by Fig. 9 an eye set where B T, B′ T′ intersects, would very conveniently see the remote source of light. This is akin to the case of the earth's atmosphere during a lunar eclipse, but the varying density of the air causes the region whence the sun can be wholly seen in ring form to be much larger than it otherwise would be: an eye set further away would see a ring image by higher layers—that is all.

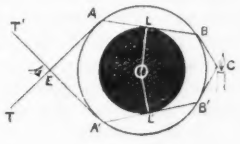

Fig. 10.

We may, however, even in the case of shells of glass—were it even flint glass—see a light turned into a ring in the way illustrated in Fig. 10—where C represents the flame of a candle, seen through a shell of crown glass by an eye at E. (A shell of crown glass must have a thickness equal to one-third the radius of the complete sphere.) For water—as anyone can in a minute try with a globular decanter full of water—the experiment is still more convenient. (Stand a rod upright in the bottle if you wish to prevent the direct image of the flame from being seen.) In this case, a shell as in Fig. 10 would require to have a thickness equal to one-fourth the radius of the sphere. But in all such cases the light comes tangentially from A and A′. [It is interesting to note that while a point of light may be thus changed into what looks like a very fine thread of light *at the very outskirts of the globe*, the rays by which the point is thus seen have approached the centre by a full fourth of the globe's radius.]

The mistake must not be made of regarding E in Fig. 6, or C in Fig. 10, as foci, for they have no focal character. Still less must one imagine E and C in Fig. 10 to be as conjugate foci to each other.

And now a word of explanation as to my reason for clearing up this whole subject till the last doubt or difficulty has been (as I trust) removed,—even at the risk of seeming censorious in regard to statements of opinion by my friend Mr. Mattieu Williams. On this particular subject, or rather on that part of it about which I have written here, I am well within my own ground. Mr. Williams was outside his, though not knowing it. There are many subjects in which, were I to venture, I should be on his ground and outside my own. It is very easy to fall into errors in so venturing, errors even which might be easily twisted so as to seem to imply ignorance in a grosser sense than mere want of knowledge. I will take as an example a mistake of my own—too silly for any use, as Americans would say—("I will [correct any error that I see, or seem to see, *but* I will] *rail* against no breather but myself, against whom I know most faults," all other railing, scoffing, and the like,—unless provoked by persistent conceit [or rudeness],—being to my mind hateful):—Dealing with hypothetical explosions of mixed oxygen and hydrogen in the sun, I said they would create an inrush, because the water formed would occupy much less space than the gases had occupied—forgetting that it would be water in the form of steam, (that is, a vapour, not a liquid), which would really be formed—and though there would be, I believe, a diminution of volume, it would be nothing like what I had fondly imagined and carelessly suggested.

If readers, including Mr. Williams, will kindly understand that I have corrected him (and on a minor point my friend Mr. Ranyard) only as I wish others to correct me, or as, failing that, I will try to correct myself (only I always feel free to scoff a little at my own mistakes), they will not I think misjudge my discussion of the Ruddy Eclipsed Moon. They will see that if I have been *tenax propositi*, I have wished at any rate to be *justus* also,—just as I ought to be.* Possibly it may further serve the purpose of showing the spirit in which I strongly feel that all scientific inquiry should proceed.

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* In order to render Fig. 9 perfectly clear, the reader should draw straight lines A L B, A′ L′ B′, which were accidentally omitted in the drawing.

THE PHILOSOPHY OF CLOTHING.

By W. Mattieu Williams.

XVIII.—CORSETS AND FEMALE FASHIONS.

THE evils of clothing having the character of bandages were referred to at the conclusion of my last paper. Such bandages not only interfere with the free and natural movements of the body, but in proportion to their impermeability they interfere with free transpiration from the skin. There is still another evil, long ago pointed out by Dr. Andrew Combe ("Physiology applied to Health and Education"). Speaking of female dress, he says, "From the tightness with which it is made to fit on the upper part of the body, not only is the insensible perspiration injudiciously and hurtfully confined, but that free play between the dress and the skin, which is so beneficial in gently stimulating the latter by friction at every movement of the body, is altogether prevented, so that the action of the cutaneous nerves and vessels, and consequently the heat generated, are rendered less than would result from the same dress more loosely worn. Every part and every function are thus linked so closely with the rest, that we can neither act wrongly as regards one organ without all suffering, nor act rightly without all sharing in the benefit."

I commend these wise words to the consideration of ladies who are considering whether or not they shall take the really very important step of discarding corsets and heavy hip-supported skirts. Their whole personal welfare, their capacity to enjoy life and perform its duties,

* But ought you to jest as here?—*Printer's devil.*

and consequently their influence on others also, are concerned by reason of this inter-relation of the organic functions.

This brings me to the subject of stays and tight lacing. Many of my readers possibly expect that I shall reproduce the well-known picture of the Venus di Medici contrasted with that of a tight-laced cripple (a Venus *di Meretrice*), showing how the ribs are crushed in just where they should expand, and the consequent derangement of the thoracic and abdominal viscera; but I abstain from thus wasting my time or otherwise arguing against such practices, knowing well that the exceptionally few women who *now* deform themselves by such mechanical violence are below the reach of reason. Besides this, the suicide they perpetrate is beneficial to society; it promotes "the survival of the fittest." If such women lived to be mothers of families their like would be multiplied and occupy the places of the more worthy. If they only take rope enough—*i.e.*, pull hard enough at the staylaces—they will die early; if they pull not quite hard enough for this they may survive a little longer, get married, and die in childbirth; or a little less still, they may survive this ordeal, but have premature or stillborn children. No woman who is so devoured by insensate vanity as to deform herself by tight-lacing is fit to become a wife and a mother.

There is, however, another use more usually made of stays or corsets which stands quite apart from tight-lacing, and which still prevails among a large majority of the best of women, but which nevertheless is an unmitigated evil. I allude to the common practice of wearing stays as "a support."

A glance at the human skeleton shows that the internal abdominal organs, or viscera, are mainly supported by the basin-shaped expansion of the hip-bones—the pelvis—while the head and shoulders, the arms, and the bulk of the trunk are all held up by a comparatively slender stick of bone (the backbone), which, on further examination, is found to consist of twenty-four pieces, not rigidly attached by dovetailing or otherwise, but somewhat unstably united by intervening layers of flexible cartilage. Standing alone, it is not able to hold itself upright, but yields and bends over by its own weight if inclined in the least degree on either side. Added to this, it is curved considerably.

How, then, is it that man is able to maintain the erect position during life, and—if healthy—to do this so easily? It is by means of a system of muscles attached to the processes or projections of this back-bone. Some of these proceed directly from the processes to the edge of the pelvis, and act in a manner that has been justly compared to that of the shrouds and stays that hold the masts, and with them the sails of a ship, in their places in spite of the great overthrowing strain which a strong wind exerts upon the sails. Other muscles are variously arranged, forming the fleshy mass of the back, &c., and combine, with the above-named, not only to stay but at the same time, by their alternate contractions and extensions, to execute the movements of the body.

These muscles, like those of the limbs, require daily regular exercise, in order that they may retain their normal healthy amount of energy or power. This exercise must consist of their full contraction and extension.

It must be evident to any intelligent woman that if she surrounds her body with a closely-fitting scaffolding of whalebone and steel-busks, or any similar scaffolding or stiff bandage, the free action, the healthy exercise of the muscles concerned in the support and flexure of the body must be impeded in proportion to the rigidity of such bandage. If the right arm were similarly bandaged and its muscles similarly restrained it would soon become weaker than the left—almost useless in fact; if the legs were similarly treated the victim would, in the course of time, become unable to walk a single mile.

Thus it is that the practice of wearing stays, commenced in girlhood, merely in blind obedience to custom (forwarded in many cases by the girl's desire to be womanlike, as little boys smoke pipes and cigarettes to appear manly) produces the weakness that in after life creates the demand for their continuance. The case is just analogous to that of snuff taking, smoking, and other bad habits, which create a special weakness temporarily relieved and permanently exaggerated by their continuance. The snuff-taker, when deprived of his box, is miserably depressed. Had he never began snuff-taking he would suffer no such depression. The stay-wearer when deprived of her stays feels miserably weak and flaccid. Had she never worn stays she would suffer no such misery.

The remedy is the same in both cases. Resolution is demanded; the consequences of the vice must be endured for awhile, until the artificially weakened organs recover their healthy tone. I am told by emancipated ladies that they found the struggle much less severe than they had anticipated. This will probably be found in all cases where the abandonment of stays is accompanied with the adoption of divided underskirts of far less weight than the ordinary strata, and with the other suitable under-clothing now so well understood by dress reformers.

I must not leave this part of the subject without a word in recommendation of those admirable knitted body garments known as "Cardigan jackets." Made of pure wool, they combine nearly all the qualities demanded theoretically in ideally perfect clothing. During a recent visit to Scotland, I was much pleased to see they are still worn there by school-girls and sensible women as commonly as when I lived there more than thirty years ago. The school-girls then knitted them for themselves. I hope they continue to do so.

They are suitable for men as well as for women. The only objection I have heard against them as men's garments is that they are worn by barmen and pot-boys. This may have some force in the case of men whose social position is doubtful, and whose avocation might, therefore, be mistaken. But even in their case there is a remedy. Let them wear Cardigan jackets made with visible outside pockets. The barman wears a knitted overall jacket without pockets, and tight at the wrists, as a protection to his employer's till.

This is my last paper on this subject, and it may suitably conclude with a few remarks on the moral philosophy of clothing, especially of women's clothing. As they devote so large a proportion of their moral energies so much thought and earnest feeling, to the subject, and this from an early age, its educating influence on the formation of their character must be considerable; and their conduct in reference to this subject may be fairly regarded as a prominent indication of character.

What, then, must be our verdict if we analyse this influence, and apply this test for the determination of whether the intellectual conclusions and practical conduct of women generally are or are not based upon fixed intellectual and moral principles.

What are the principles, are there any principles, or any idea of principles, or respect for principle, regulating the mind and conduct of women (I mean average, not exceptional, women) in the very engrossing business of the selection and general conduct of dress?

I am unable to find any beyond that of a blind obedience to some invisible, absolutely occult, dictatorship of fashion. The question is not what is desirable to wear, on either sanitary, economical, or artistic grounds, but simply what *is* worn, or what is likely to be worn presently. It is not merely a game of follow my leader, but the following of an absolutely unknown leader. Who is the dictator or designer of those caricatures that appear in the fashion-books, the ladies' newspapers, &c.? It is an invisible, unknown ring of millinery traders, whose business is simply to lead their victims on from one absurdity to another, never allowing any to be permanent, lest the poor sheep should fail to be fleeced at each succeeding season by continuing to wear the dresses or bonnets of the last season.

These fluctuations are void of the slightest basis or pretensions to a basis of personal convenience, good taste, reason, or any other element capable of alleviating their absurdity. One day it is decreed that the elegance of a skirt is proportionate to its circumference and outward projection, and complex machinery of iron hooping is invented to distend it. So long as the fetish of fashion maintains this decree its worshippers are compelled to admire the abomination, and actually pervert their natural sense of beauty sufficiently to do so. Presently the invisible Moloch orders that skirts shall be narrowed, shall be limp and clinging to the legs, shall be extended behind in hideous humps and trails. Then these become admired, and the proprietor of a dozen yards of humps and draggle of costly material is envied by her poorer sisters who cannot afford to stir up the dust or sweep the mud with more than two or three yards. The "duck of a bonnet" of to-day is the vulgar "fright" of next season, and not the smallest approach to any rational excuse can be pleaded for the change of taste. It is simply morbid. What a chaos of contradictions must infest and stultify the intellect of women who are subjected to this continuous training in inconsistency!

Besides this undermining of the judgment there is the degrading bondage of ever following the folly of the foolish, and never daring to act independently.

Nobody can desire more earnestly than I do to see the views of John Stuart Mill concerning female suffrage carried out; but I dare not advocate their adoption, fearing that women's ideas of political propriety will be as changeable as their notions of personal elegance, and that if they had votes invisible political wire-pullers would enslave them for their trading purposes as effectually as milliners, dressmakers, hair-dressers, boot-heel makers, &c., at present succeed in torturing and degrading them. If they have not sufficient moral and intellectual independence to enable them to select a convenient and becoming style of dress, and having chosen it to adhere to it, are they likely to use their own independent judgment in the selection of members of Parliament? If they have no approach to fixed principles for the guidance of their taste, are they likely to have any principles for the government of their politics?

If they continue to deform their heads and sprain their ankles at the dictation of Parisian milliners, are we not justified in fearing that they may follow the fluctuations of Parisian politics, or bow down to some other analogous dictatorship. It would be fatal to the nation if an important proportion of the constituency were capable of being led blindly, submissively, and unthinkingly by an outside interested dictatorship, such as that which governs the senseless fluctuations of fashion in female dress and so easily enslaves the whole sex.

Let not the gentlest of my "gentle readers" misunderstand me; I am not railing against pretty dresses, pretty bonnets, pretty ribbons, or any other really pretty decorations for pretty women—and all women are pretty, more or less. On the contrary, I maintain that beauty being one of the natural attributes of woman, she is bound to cherish and cultivate it most religiously. Due and proper attention to dress is one of the domestic duties of all women, especially of married women. The wife who neglects her home dress fails in one of her duties to her husband. But such dress should be designed in accordance with the *fixed* principles of good taste and suitability to occupations and means. The cheapest dress of the poorest woman may be tasteful and elegant; the dress of the kitchen, of the nursery, or the drawing-room may all have these attributes combined with suitability. But the fulfilment of these conditions of good taste is obviously impossible if the pattern of dress is compulsorily changed from season to season in obedience to mere caprice, void of any element of that progressive improvement which alone should be the motive of every change.

PIONEER PASSENGER RAILWAY.

FIFTY-FIVE years have elapsed since the opening of what may be regarded as the first passenger railway ever constructed in this or any other country. Although the Stockton and Darlington line was the first railway ever constructed in England, having been opened on September 27, 1825, it was primarily intended and used for the transit of coal, lime, and bricks from the interior to the seaboard. It is true that, in the following month, a passenger coach was placed on the line, drawn by one horse, and performing one journey daily between the two towns, travelling at the rate of about nine miles an hour. The waggons containing coal and other merchandise were drawn by a locomotive built by George Stephenson, the maximum speed being from ten to twelve miles an hour. The 15th of September, 1830, will therefore be remembered, for all time, as the day on which travelling by steam-power on a large scale was inaugurated, in the opening of the Liverpool and Manchester Railway, where the complete success of the locomotive steam-engine was accomplished; the "Northumbrian" engine, on that occasion, with the Duke of Wellington and other distinguished visitors in the train, attaining a speed of thirty-six miles an hour. Following upon the opening of the Liverpool and Manchester line, the construction of railways in different parts of the country rapidly succeeded each other, and it is interesting to look at what has been accomplished in this branch of engineering during the last half-century, not only as regards our own country, but also in Europe and other foreign regions. Confining our notice to the United Kingdom, we find, according to the last official return, brought down to the close of the year 1884, that the authorised capital in respect of the lines now opened for traffic was, at that period, £742,417,327, and the aggregate length of railways 17,512 miles, which will shortly be still further increased by the completion of the several new lines now in course of construction. The total outlay in the construction of the lines now open, down to the end of last year, was £628,276,016, and the estimated further expenditure during the present year is upwards of £12,000,000. What may be classed as the fifteen leading lines, which have from time to time absorbed so many

of the smaller railways into their respective systems, represent £644,246,356 of the total capital of the various lines open, leaving £78,718,559 as the capital of the remaining lesser lines. The fifteen leading lines, as above named, have an aggregate length of 13,475 miles, an analysis showing that, as respects mileage, the Great Western Company stands at the head, while the London and North-Western Company has the largest amount of capital, being £101,771,907, with a mileage 1,794 miles in length. As regards capital, the Midland Company is next in amount, with £76,549,267, and 1,270 miles of railway. The capital of the Great Western Company is £75,108,424, and its length of railway 2,301 miles. Then follow the North-Eastern, with a capital of £57,650,895, and 1,536 miles of railway; the Great Eastern, capital £41,087,103, and 919 miles of railway; the Caledonian, capital £36,324,700, and 772 miles; the Great Northern, capital £35,380,050, and 949 miles; Lancashire and Yorkshire, capital £41,852,949, and 496 miles; North British, capital £33,576,211, and 984 miles; Manchester, Sheffield, and Lincolnshire, capital £27,248,627, and 291 miles; London, Chatham, and Dover, capital £25,634,008, and 176 miles; London and Brighton, capital £23,768,899, and 455 miles; South-Eastern, capital £21,915,824, and 385 miles; London and South-Western, capital £29,455,931, and 818 miles; and Glasgow and South-Western, capital £13,921,570, and 330 miles.—*The Times.*

NITRIFICATION.

By E. W. Prevost, Ph.D.

THERE are several questions which are frequently asked by an inquiring person possessing scientific proclivities; whenever he sees or hears of natural phenomena which have not been explained to him, but which he thinks are capable of explanation, he launches out with "How does that happen?" "What makes it do that?" But such questions as these are most generally asked of phenomena occurring above ground, or if asked of anything taking place below ground, it is usually in connection with something more or less visible; as, for example, the inquirer is aware that after a grain of wheat is sown, it will sprout and grow; his questions are therefore directed to the cause of its sprouting, and the food of the future plant, &c. But concerning that which to the general observer is invisible there is but little curiosity evinced, and it is to one of these invisible phenomena that I now wish to direct the reader's attention, for although the phenomena referred to has been known for many years past, yet it is only quite recently that the true explanation has been forthcoming.

I have in previous articles referred to those constituents of the soil on which the plant, when growing, feeds; and I also showed that all the food derived from the soil must be in a state of solution. My object now is to direct special attention to the very important food, nitrogen, which exists in at least two forms of combination, both of which are soluble in water, but one is of use to and is absorbed by the plants, whilst the other must be converted into the first, otherwise it is of no use. For the first form nitrogen is combined with oxygen, and exists as nitric acid combined with lime (calcium nitrate), and in general it is spoken of as the "nitric acid" in the soil; the second appears as a compound of ammonia, where the nitrogen is combined with hydrogen, and it is, I repeat, in this form that nitrogen is not acceptable to plants, though it is soluble with ease in water. Now no large quantity of "nitric acid" (nitrates) exists in any soil, because the demand on the stock is heavy, the supply being barely sufficient to keep up the stock; there is also a further reason for this deficiency, and that is to be found in the very solubility of the salt itself, and the incapability of the earth to retain nitrates, as it does most other compounds; the consequence of all this is, that much of the most valuable material is to be found constantly, and at all times of the year, but more especially during wet, wintry weather, in the drainage waters. Whence, then, comes this nitric acid, which, if there were not an unfailing and continuous source, would so soon be absent from our soils? The knowledge that compounds of ammonia may be converted into nitric acid—that, under certain conditions, oxygen may replace hydrogen—is not of very recent date, but the cause of this conversion in the soil has been ascertained only during the last few years.

It was not until 1877 that Schlösing and Müntz showed that this process of conversion, now called nitrification, was due to an organised ferment, and our more extended information is very largely due to Mr. Warington, at Rothamsted. It would occupy a far greater space than the editor can spare to describe fully all the results which Mr. Warington has obtained, so that it must suffice to state in as few words as possible the chief points. That the ferment shall grow it is necessary that nitrogen in some form other than that of nitrates be present. The process is slow at 0° C. (32° F.), increases as the temperature rises up to 35° C. (91° F.), at which point the action is at its maximum, after which it decreases until 55° C. (131° F.) is reached, when it ceases altogether. Like all other ferments, antiseptics are fatal to its action. The nitrogen in sewage or soil heated to the boiling-point of water will no longer be converted into nitric acid as the ferment is killed, but if some fresh soil be introduced into the sterilised liquid, then nitrification recommences. Knowing now these the chief points in the discovery, let us see what effect the conditions under which nitrification proceeds has upon the soil in a field. Taking it, therefore, that we have abundant proof that it is to the nitrogenous compounds in the soil that we have to look for the supply of nitrates, are we to believe that nitrification proceeds actively all the year round, when in winter the plants hardly grow and require but very little nitrogen, and when great loss would occur through the heavy rains and melting snow washing away valuable material? No, certainly not; for the ferment decreases in activity as the temperature falls, so that when the ground is frozen there is no formation of nitric acid; in the lower stratum of soil, when the temperature has not fallen below 0° C., there is, of course, some nitric acid being produced. Part of this may be absorbed by roots of the crop in the land, whilst the rest will most probably be lost.

Being acquainted as we are, and as I have pointed out in a previous article, with the valuable changes taking place in the soil during winter and summer, we are now more able to appreciate one of the disadvantages of permitting a field to lie fallow—*i.e.*, to carry no crop during winter and summer. I do not wish to argue that fields should not lie fallow, for there are very many benefits derived from such a state of affairs, but I am anxious to point out clearly that there is a loss incurred. In the summer the temperature is high, and consequent active nitrification takes place; but as there is no crop to take

up the nitric acid, the first rains wash it all away; then, again, all the winter through, if it is mild and wet, there is a constant loss, which is reduced when the weather hardens, and the ground temperature falls to 0° C. The natural remedy is always to keep something growing on the land; but this is not advisable on some classes of soil; and as other and great benefits accrue from a bare fallow, the advantages may, perhaps, more than balance the disadvantages; more than this I shall not say, as I might enter within the bounds of a controversy unacceptable to the readers of KNOWLEDGE.

EARTHQUAKE REGIONS.

BY RICHARD A. PROCTOR.

EARTHQUAKES occur in all regions adjacent to active volcanoes. Thus the neighbourhood of Vesuvius, Etna, and Teneriffe is infested by subterranean convulsions, which also are frequent over the neighbourhood of the Greek Archipelago, and in Syria. In fact it seems probable that the whole of the Mediterranean basin and the surrounding lands for a distance of many miles from its shores form a single earthquake district, whereof Teneriffe, Vesuvius, Etna, Stromboli, the Archipelagic and the Syrian volcanoes are the safety-valves. Then there is another earthquake region surrounding Hecla or—some say—extending in a long line from the Jan Mayen volcano, through Hecla, the Azores, and the Cape Verde Islands, to St. Helena and Tristan d'Acunha. Japan, Sumatra, Java, and the islands of the East Indian Archipelago are liable to fearful earthquakes,—some of the most destructive of which have occurred within the past few years. In the West Indies there is another earthquake region, to which must be referred those which have recently taken place. Probably this district belongs to the great earthquake region in Columbia and Peru, around the celebrated volcanoes Cotopaxi and Chimborazo. The south-western district of the United States is also liable to earthquake shocks, apparently referable to the great Mexican volcanoes. There is one region of the earth in which subterranean shocks occur which cannot be referred to the neighbourhood of volcanic vents. Upper India and parts of Western India are liable to frequent earthquakes, insomuch that between the years 1800 and 1842 no less than 162 earthquakes were recorded in these places. Undoubtedly we may trace these disturbances to the great mountain chains which traverse this part of Asia. The subterranean forces which upheaved the great Himalayan range, for instance, may be assumed to be still existent, though now for a while dormant, or "perhaps," says Sir John Herschel, "expended in maintaining the Himalayas at their present elevation."

On the other hand there are some regions wholly free from earthquake shocks. Among such may be mentioned the great alluvial plains of America east of the Andes, the plains on the north-east of Europe, and the northern parts of Asia. There are monuments, natural and artificial, which prove the absolute fixity of some regions. The slightest shock would have flung down that strange mass which is perched upon the summit of the Peter Botte mountain, 1,500 feet above the sea-level. Pompey's Pillar justifies the assertion of Strabo that Egypt has long been free from earthquakes; though nothing short of subterranean convulsion could have flung down the more ancient obelisks which lie prostrate amidst the sands of Western Lower Egypt. Even that masterpiece of Egyptian labour, the Great Pyramid, though surpassing all other human erections in stability, shows unmistakable evidence of the slow action of subterranean forces*. In Mexico, again, in the very centre seemingly of earth-rocking forces, there is a region in which rocks of grotesque figure attest the perfect immunity which the region has enjoyed even from inconsiderable shocks. The Cheese-ring in Devonshire is another instance of the kind of evidence we are considering.

And as there are instances of regions near to a disturbed district which yet are free from shocks, so there are spots liable to frequent shocks though the neighbouring country for miles on every side is seldom (if ever) disturbed. Such is the district—very limited in extent—near Comrie, in Perth, where a year scarcely ever passes without a shock being experienced.

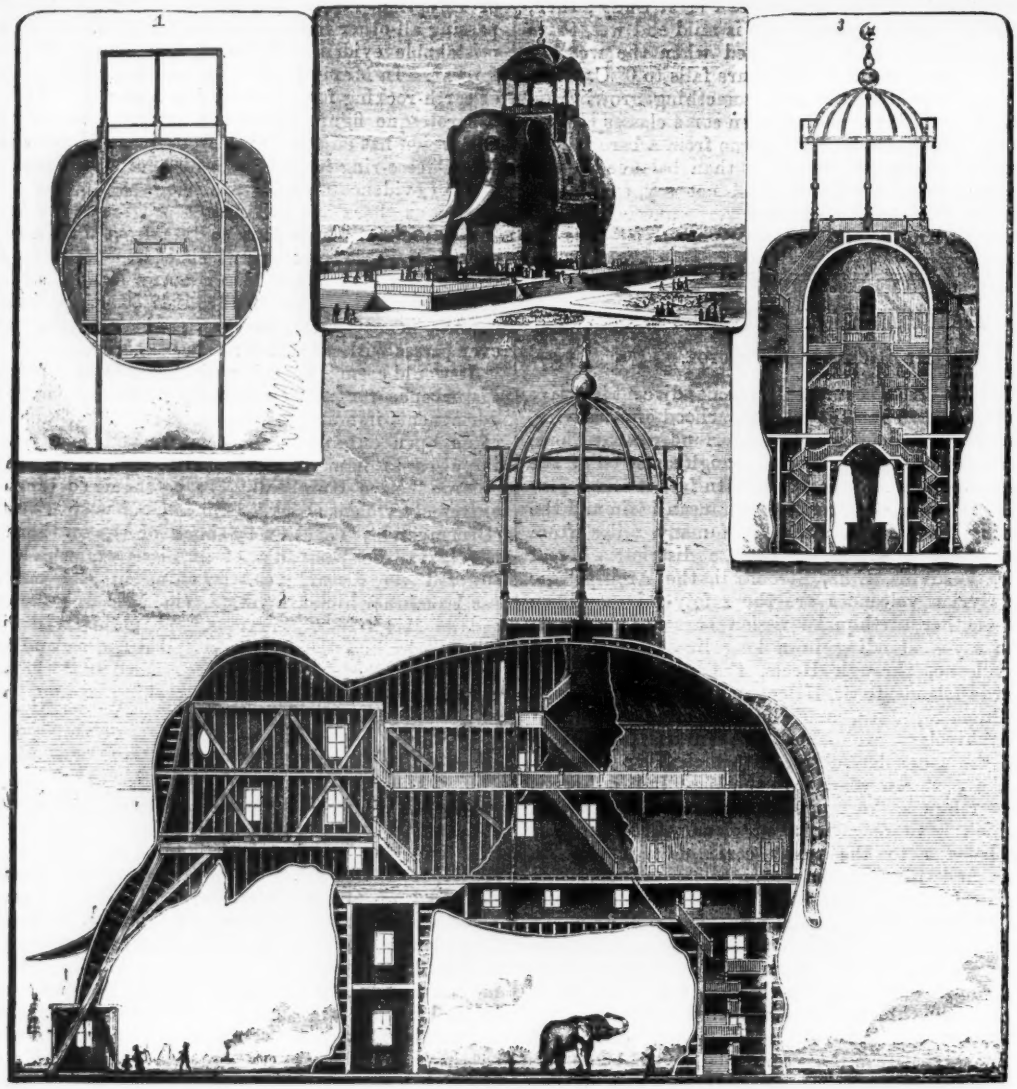
It would seem also as if regions free from subterranean disturbance for many centuries must not count upon permanent immunity. For a violent earthquake will often open out, as it were, a passage for subterranean impulses to new regions. "The circles of concussion enlarge," says Humboldt, "in consequence of a single extremely violent shock." Since Cumana was destroyed (December 14, 1797) every shock of the southern coast is felt in the peninsula of Maniguarez, which before suffered no disturbance. Again, in the successive earthquakes which traversed (in 1811-13) the valley of the Mississippi, Arkansas, and Ohio rivers, it was noteworthy how the motion travelled farther and farther northward on each occasion. It seemed as if the subterranean forces were gradually breaking a way through successive barriers.

THE COLOSSAL ELEPHANT OF CONEY ISLAND.†

THE reputation that the American people have long had of always doing everything on the grandest possible scale has lately received a very substantial confirmation in the two monuments that have recently been bestowed upon this country. The Washington Monument and the statue of Liberty are the greatest works of art in height and magnitude that have been raised by the hands of man since the Tower of Babel. In addition to these there is a third monument, facetiously styled the eighth wonder of the world, that has recently been raised in the neighbourhood of New York, that for one reason deserves to be named in the same connection with the foregoing—namely, on account of its size. The Colossal Elephant at Coney Island has not been favoured with much serious public attention, owing to the fact principally that it is not an artistic work, and, secondly, because it is the project and property of a stock company, whose unexalted aim was to rear a structure that would serve, not so much to elevate the public mind artistically, nor to stand as a monument to some of our noted forefathers, but rather to abstract the unwary dime from the inquisitive sightseer. This fact, and the grotesque nature and enormous size of the colossus, has deprived it, up to this time, of much consideration, but this should not deter us from inquiring how a building of such unique design and original construction was called into being.

* "The quantity of the post-pyramid *tilt*," says Professor Piazzi Smyth, "appears to be about thirty-seven seconds," as given by the corner angles of the Great Pyramid.

† From the *Scientific American*.



The Colossal Elephant of Coney Island.

It was designed and built under the personal supervision of the architect, Mr. J. Mason Kirby, of Atlantic City, New Jersey. It was first intended to make it an hotel, but later this idea was abandoned, and it was decided to construct the interior with the purpose of using it as an auditorium for concerts, &c., while the platform on the top, or the howdah, as it is termed, would serve as an observatory. The elephant is constructed of wood throughout, and is covered with sheet-tin. The total length from the trunk to the back part of the hind legs is 150 ft. The platform of the howdah is 88 ft. from the ground, and the total height to top of crescent on flag-pole is 150 ft. The height from ground to body, when standing immediately underneath, is 24 ft. The legs are 18 ft. in diameter, and the two hind legs are provided with circular stairways leading to and from the rooms above.

The first room reached in passing up the stairs is termed the stomach-room, and is dignified with this title, not because it is provided with the wherewithal to cheer the inner man, but owing to its special location in the body of the beast. The different rooms in the animal are likewise christened after their particular location, as the thigh-room, brain-room, hip-room, &c. The grand hall, or auditorium, is reached upon ascending the stairs, and this is found to be very spacious and airy, the ceiling being very high and slightly dome-shaped. A gallery passes all round the hall. At the further end of it a flight of steps lead to what forms, in fact, a continuation of the main hall, only on a higher plane. The main hall is 80 ft. long and 32 ft. wide, while the upper part of the main hall is 36 ft. long and triangular in shape. There are thirty-four rooms in the structure in all, which are located principally between the walls of the hall and the outer walls of the structure. Most of them are quite small, and are very extraordinary in shape, their walls conforming to the shape withou of that particular section of the colossus. The eyes

which form the windows of two of these rooms, are 4 ft. in diameter. The tusks are 36 ft. long and 5 ft. 8 in. in diameter.

In laying the foundation of the structure the builders met with some difficulty, owing to the instability of the soil, it being simply a sandy beach. Piles were driven to a great depth, and a solid platform was raised on top of the piles and secured firmly thereon. A second platform, which was designed to bear the direct weight of the colossus, was constructed above this, and was supported on vertical timbers strengthened by inclined braces reaching to the platform, with a view of resisting great lateral as well as vertical strains.

After the foundations were completed, work was commenced upon the visible portion of the building, the legs being the first point of attack. Yellow pine posts, 12 by 16 inches, were first raised above the platform, and, being bolted to the flooring beneath, were made self-supporting. Two posts, 42 ft. long, were thus raised in each leg, and twelve smaller timbers, placed in a circle so as to inclose the main posts, were also bolted to the platform in a similar manner to form the outer wall of the leg. These timbers were joined at the top by connecting beams.

Cranes were mounted on the platforms thus formed, to which the material was raised as the work progressed. The difficulties increased, however, with the work, and it became necessary to secure the services of the most skilled workmen. Not only was this so on account of the dizzy height that the structure attained, but to the necessity of conforming the construction to the peculiar emergencies that arose, it being requisite to form nearly all the parts on the spot, under the immediate personal supervision of the architect. The weight of the structure is carried, as may be seen by the engraving, by five supports, the four legs and the trunk.

Commencing at what is now the flooring of the main hall, trusses were raised on each side and at the two ends of the hall, and these trusses (the bottom chords corresponding with the floor and the top chords with the ceiling of the hall) constitute the principal support of the ribs. It will be seen from this that what might be termed an immense box girder was formed, the ends of which are supported by the front and hind legs respectively.

The ribs weigh directly upon the upper chords at the four corners, but at other points the ribs bear away from the chords, owing to the enlargement of the body under the howdah. At these points it was necessary to extend the vertical and horizontal members of each truss from the wall and ceiling until they intersected with ribs. In addition to this, an arched rib, corresponding to the backbone, is carried from the main support of the hind legs to the neck of the monster, where it bears indirectly upon the vertical support of the front legs. The ribs in the body of the colossus are forty in number, and each consists of six sections bolted firmly together. As they serve to give consistency and rigidity to the whole structure, they form an important element in its construction, They are about 7 in. in width, and are placed 2 ft. apart, measuring from centre to centre. The head framing is similar in general construction to that of the body, and is supported by the trunk and forward supports of the front legs. It is provided with twelve ribs. Great difficulty was experienced in raising the ears and adjusting them in position in the head. This was principally due to their enormous weight—some six tons each—and the great height to which they had to be raised, and the difficulty of securing such an enormous mass securely to the drums which had been prepared to receive them in each side of the head. In addition to being bolted firmly in position at these points, iron rods were extended from the main trusses within through the ears at two points below the drum. The ears are some 34 ft. long by 20 ft. wide.

The architect depends upon the enormous weight of the elephant, and upon iron rods that pass from the trusses above, through the legs, and connect with the foundation platform, to hold the colossus in its position. He has kindly furnished us with a few statistics that may be of interest. The colossus, he informs us, weighs about 100,000 tons. It contains 1,500,000 square feet of timber, and 700 kegs of nails were consumed in its construction. In addition to this, 7 tons of bolts were disposed of, and it required 35,000 square feet of tin to cover its surface. In size it compares favourably with many of the large hotels and other structures in its neighbourhood; and some idea of its magnitude may be had by comparing it with Jumbo, which is drawn in scale by its side, and which would find plenty of room for a promenade within one of the legs of the colossus.

RATIONAL DRESS.

WE quote the following interesting paragraphs from the reports of the Rational Dress Society:—

Miss Sharman Crawford, a member of the Committee, who passed last winter in America, brings an encouraging report of the interest taken there in dress reform.

For the present, however, the reform in that country is almost exclusively limited to underclothing, in which department boneless bodices as a substitute for corsets are a conspicuous feature. The weight of the fashionable skirt is generally deplored, but the contumely to which ladies who adopted the Bloomer dress were subjected impelled many to submit unwillingly, as the lesser evil, to the dresses of the prevailing *mode*, and by these the divided skirt has been welcomed as affording in a considerable degree a solution of the perplexing problem of the reconciliation of personal comfort and public approval.

In San Francisco, where Miss Sharman Crawford gave a drawing-room lecture on the subject of Dress Reform, an urgent request for patterns of the divided skirt she wore was made by the ladies present. In Boston, too, she found the divided skirt regarded with much favour, and there also the patterns of the dress were much solicited.

In America the prevalence of rational ideas in reference to shoes was also clearly shown by printed labels bearing the inscription "Common Sense Heels" frequently seen in the windows of shoemakers' shops.

In California several ladies accustomed to riding constantly complained of the unnecessary fatigue to which they were subjected by the use of the side-saddle, and several said that on mountain excursions in the summer-time they frequently rode with ordinary saddles, adopting for the occasion a kind of Bloomer costume. Not only did this departure from conventional rule give them increased security and relief from the cramping effects due to a constrained position for several consecutive hours, but their horses derived great benefit from the removal of that unequal pressure which so often renders the side-saddle an instrument of torture to animals.

So serious has been the injury inflicted on horses by side-saddles, that in one town in California a livery stable-

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keeper refused to supply ladies with any horses for riding. From her own experience during an Algerian riding-tour, Miss Sharman Crawford confirmed the disabling effects of side-saddles on horses, and also the personal benefit derived from adopting a more natural position.

The Committee desire to call the special attention of the Society to this point, and to the dependence of "rational riding" upon reform of a "rational" kind in dress.

Miss Sharman Crawford reports that a curious instance of tyranny and intolerance in regard to feminine attire occurred lately in America. Some ladies in a town in the State of Montana, adopted for outdoor wear a long, loose gown ungirt around the waist, somewhat resembling the Mother Hubbard Mantle. Not only were the wearers of the dress hooted in the streets, but, in deference to public opinion, which affirmed that purity of morals was incompatible with such looseness of attire, the objectionable innovation was *suppressed by municipal decree*. The newspapers which announced the fact found no fault with the Mayor's action, nor did any editor seem to find anything ludicrous in the inference to be drawn; namely, that tight-fitting jackets were henceforth legally recognised as the visible evidence of high principles and moral worth. The attention of the Mayor of Philadelphia was likewise called to the fact that ladies in his municipality were wearing the Mother Hubbard costume. His worship was, however, of opinion that the matter did not necessitate an official decree!

The English press still continues to discuss the subject of dress reform with unflagging interest, and as all the Rational Dress Society's members may not have seen the articles which have appeared in various papers on the question, your committee append a few extracts from letters, &c., recently published, which will probably interest the champions of Reform.

In comment on an article which appeared in the *Daily News* disparaging the artists of the present day, a member of the Rational Dress Society writes as follows to the editor of the *Daily News*:—"Sir,—Is not your brightly-written leader on our unsuccessful artists a little hard on them? In one way, at all events, they have fallen upon evil days. The costume of their time is contemptible. The streets should be their schools—would have been so in Florence, in Venice, in the Low Countries, in times past. The artist had but then to draw fairly well a figure as he saw it, and behold a picture! For costume was then picturesque. If, however, he only drew faithfully what I saw a few days ago in Mayfair, he would pourtray a young girl who, between padding in some places and pinching-in in others, had come to resemble a stuffed pincushion. She could not walk. She literally tottered, owing to her pointed-toed and high-heeled shoes, her severe lacing, and cumbersome skirts. Think of the difference between sitters who came to Vandyke, and those, though they be their lineal descendants, who sit for their portraits to day! . . . . I will try to make a faithful picture in words of a lady, an earnest devotee of fashion, one who is a type of many women, and I ask you what inspiration can a painter draw from her and others of her kind? Her waist, which is down among her digestive organs—or physiology lies—measures seventeen, or at most eighteen inches; whereas the waist of the little Medician Venus is twenty-six . . . . She wears a crinolette or dress-improver, looking like what is known in architecture as a flying buttress. I involuntarily shudder lest she may snap at the narrowest point, but she does not, she does not even make moan . . . . She knows she is in the fashion, 'Il faut souffrir pour être,' not 'belle,' for no one with an eye for the beautiful could call her so, but 'à la mode.' Perhaps a painter of sardonic humour might give her grotesque outline a place in a new 'Dance of Death' . . . . But what is there in her to gratify the artist's eye? Beauty of form? Rather deformity. Flowing drapery? Oh, no, nothing but the solid edification of that wretched flying buttress. Grace of motion? Not so much as is possible to a Dutch doll! Could Giotto have invented his lovely 'dancing girls' had he looked on the costumes in London in this year of grace 1885? Where would even Guido's 'Hours' have been under such unhappy sartorial circumstances as ours? Is there not some excuse for our unsuccessful artists?"

A correspondent of the *Pall Mall Gazette*, in a letter headed "Ladies' Dress, Æsthetic and Artistic," says:—"If we can teach the right principles that underlie all good forms of dress, that is as much as we can aim at. Taste is an individual possession, and as rare as any other artistic gift. What above all things we desire is to preserve the proper proportions of the human figure while allowing as much freedom and ease of motion as possible . . . . Being much interested in the efforts of the promoters of the Rational Dress movement I should like to add that the inconvenience of their dress is owing, not to its eccentricity, but to the necessity they are under of trying to make the divided skirt look as though it were *not* divided, on account of the intolerance of the British public. I trust the time will not be long before we may be allowed to wear a walking dress that is at once useful, comfortable, and artistic."

In an article in the *Pall Mall Gazette* of May 21st, a member of the Rational Dress Society writes as follows:—"We of the Rational Dress Society look down as from a proud eminence on those writers who have been pleading in your columns for frills *versus* furbelows, and puffs *versus* no puffs. As much misapprehension exists with regard to the costume of the Rational Dress Society, and especially respecting the dual skirt, I wish to describe it with what may be even wearisome minuteness. The skirt is by no means the only reform we advocate, but it is the only thing in our programme which is a departure from received notions. The skirt should quite clear the ground. Each half of the dual skirt should be a yard or three quarters of a yard at the ankle. Our Society recommends that the skirt and the underclothing be fastened to a broad band fitting round the hips, so avoiding pressure of any sort round the waist, or, if preferred, hooks or buttons can be sewn on a bodice to correspond with buttonholes on the skirt. If the weight of the skirts be hung from the waist, and not supported, as reason would dictate, by the bony framework of the body, it causes displacement of internal organs. For the top part of the dress, our Society favours any loose body or jacket, but forbids bands, ligatures, or pressure of any sort, from below the fixed ribs to the top of the hips. In our costume, the weight of clothing is minimised, because the dual skirts clothe the body fully and evenly, fewer garments are needed, and each garment is of a simpler form, requiring much less stuff to make it. We are far from saying that our costume is absolute perfection, but we maintain that we have devised a dress by which no internal organ can be injured, no muscle cramped, no movement of the body impeded, and to which the wearer may add as much grace and beauty as her own good taste may suggest."

Gossip.

By Richard A. Proctor.

The arrangements described in last week's "Gossip" will be carried out in the first monthly number of Knowledge. Mr. Jerome Harrison is preparing a paper on the "Geology of London," and Mr. Butler one on an insect of attractive household character. Mr. Slack will not I know desert us; and though his subjects are microscopical, their interest is quite otherwise. As several readers have at sundry times asked me to introduce into the pages of Knowledge a portrait of the Conductor of that widely-read paper, I have thought that the first number of the new series would be a suitable opportunity. So many engravings (sometimes from the same photograph) have presented me in aspects ranging from the utterly ferocious to the sweetly sniggering, that I have thought (not knowing which of these is right, or if any of them can be) that a Luxotype reproduction from a photograph in Messrs. Elliott & Fry's "Gallery" (which they have kindly given me leave to use for this purpose) would probably be more correct. I imagine, however, that my work is a better portraiture of all that readers care to know of me than any picture.

And by the way, now that I am taking leave of the work I have done in the column of "Replies," I may remind readers who — not having themselves asked questions — have read my answers there, that they are not to suppose I am in reality the bear I might seem to be from *some* of my answers, judged without sight of the letters addressed to me. Our lively but often wrong "Hallyards" tells me for instance that he has often *winced* at the answers I have given to others. He should have seen what brought forth those answers.

As a curious illustration of the amenities of some of those who address me, I received a few days since a letter assuring me (in effect) that I am,

(i) a liar, (ii) a hypocrite, (iii) a bungler,
(iv) a sophist, (v) a savage, (vi) a bear,
(vii) an idiot, (viii) an ignoramus, (ix) an Antinomian,

(or *not* an Antinomian, I forget which: it was meant for abuse whatever it was). All this is in the compass of four sides of letter-paper — the writing being as wide as the charges were broad. Can the general reader wonder if replies are occasionally pointed, when attacks are so bludgeonly? (I beg leave to patent this word.)

A correspondent wrote me a letter some time since signed "*Quo usque tandem*," to which I began a reply continuing the quotation *abutere patientia nostra*, then changed my mind, and inserted "It would be," altering (or intending to alter) the Latin into *Abuti patientia lectorum nostrorum*. Whether I carried out the alteration fully or not I cannot well remember; but the passage appeared in this remarkable form,—"It would be *abutere patientiam*," &c.! On this "Hallyards" and one or two others rejoicingly pounce on me with the jeer that this man who sits on our science thinks *abutere* is infinitive, ho ho! and that it governs a noun in the accusative, ha ha! (likewise hau, he, how, hi, haw!) "Hallyards" insists that "being an experienced examiner," he *knows* I thought thus. Imagine, or admit as unimaginable, the state of a man's mind who could suggest the bare possibility that, in the well-known passage which every schoolboy (except Macaulay's) knows by heart, the verb in the familiar six-words *question* could possibly be in the infinitive! * Then when I point out (to "Hallyards") that, however obvious this utter absurdity may seem to him, I at any rate did not make the mistake (*tanquam referret*), he replies that evidently editors are not called on, like other persons, to speak the truth!

But then he adds that I am "the second person he ever felt enthusiastic about," which sounds nice,—though whether enthusiastic for or against, the deponent sayeth not.

Now it is a matter of small moment to me that "Hallyards" or anyone else should abuse my Latinity, which is of a very mixed kind. (I read Latin and Greek easily, but I could not analyse a sentence worth a cent.) To give me the lie, though, when I *know* (much more certainly than "Hallyards" even imagines he knows) that I have carefully spoken the truth, *c'est par trop fort*. Yet it is "Hallyards" — believe it if you can! — who "winces" when he sees me laying on the thong. No one ought to know better than he does what occasion there has sometimes been for it.

However, I am glad to lay down an office of the most ungrateful sort and by no means congenial to me. Hereafter I appear in these pages, as I do on the platform, to reason and to study, not to argue.

Reviews.

SOME BOOKS ON OUR TABLE.

Our Insect Enemies. By Theodore Wood. (London: Society for Promoting Christian Knowledge. 1885.)—We spoke highly on a former occasion of Mr. Wood's work, "Our Insect Allies," and may reiterate our commendation in connection with his more recent volume now before us. His chapters on the aphis contain much that is as astonishing as it will be novel to many of his readers; while he treats in a manner which will command equal interest of such pests as the wireworm, the weevil, the turnip-flea, the saw-fly, the clothes-moth, the scale-insect, the bed bug and flea, and the daddy-long-legs. This is a book to be bought by every dweller beyond the sound of Bow Bells.

First Year of Scientific Knowledge. By Paul Bert. Translated by Josephine Clayton (Madame Paul Bert). (London: Relfe Brothers. 1885.)—The charm inherent in all the best French popular scientific teaching has not evaporated. In Madame Bert's translation of the really admirable little book whose title heads this notice, Natural History (including Mineralogy), Physics, Chemistry, and Animal and Vegetable Physiology are discussed and expounded in a colloquial style, which at once arrests attention. If Science is to be generally taught in elementary schools, it would seem difficult to improve upon M. Bert's volume, in its English dress, as a primer.

* "*Omnes omnia*" says an old fellow, Simo, or the like, in Terence (his "Andria" I think), "*bona dicere, et laudare*, &c., &c. ("Hallyards" will say he *knows* I know no more of the quotation, if I don't finish it, so I go on to say that the old chap speaks of his *gnatum* (*qui gnatum haberem* he says of himself, *tali ingenio præditum*,—as near as I can recollect) though the son had not been behaving "quite according" (bad grammar, "Hallyards," but I know better, indeed I do). Still the infinitives, *here*, are easily understood. No one could make *abutere* an infinitive.

Alpine Winter in its Medical Aspects. By A. Tucker Wise, M.D., L.R.C.P., &c. Second Edition. (London: J. & A. Churchill. 1885.)—This is the second edition of Dr. Wise's "Alpine Winter Cure," of which we were able to speak favourably on p. 346 of Vol. VI. A considerable amount of additional information will be found in it, and its perusal may be commended to all who suffer from incipient phthisis or "a weak chest."

Practical Chemistry, with Notes and Questions on Theoretical Chemistry. By William Ripper. Second Edition. (London: Wm. Isbister. 1885.)—Professedly "adapted to the revised syllabus of the Science and Art Department for the elementary stage of Inorganic Chemistry," Mr. Ripper's work is worthy of more attention than that generally accorded to a mere cram book. Both the practical and theoretical portion of it seem well and honestly done.

French Course, by G. H. Williams, M.A. *How to Teach Reading*, by T. J. Livesey. *The Art Student's Second Grade Practical Geometry*, by John Lowres, revised by George Brown. *Poetry for Recitation.* Parts I., II., III., and IV. (London: Moffat & Paige).—These educational books are all good of their kind. The "Practical Geometry," in particular, seems well adapted to its purpose.

What is a Lady? (London: Griffith, Farran, Okeden, & Welsh. 1885.)—In days when we may see advertisements that "A young lady wishes a situation in a baker's shop," the question put in the title of this *brochure* may seem not to admit of any very immediate or definite reply; but it will be safe to say that the woman who will fulfil the requirements, and obey the precepts of its anonymous authoress, cannot fail to be recognised as a lady in the best and truest sense of that much-abused word.

Heart or Brain?—By the author of "Before I Began to Speak." (London: Fleet Printing Works.)—Forty mortal pages does this anonymous author devote to showing that it is the brain and not the heart which is the seat of affections and desires! It would pay him handsomely to show at, say, a shilling a head, educated people now-a-days who really think that their mental impulses come from a muscular force-pump.

As it was Written.—By Sidney Luska. (London: Cassell & Co.)—Mr. Luska's astonishing novel suggests the idea that it is the hurriedly-written morning's record of a nightmare incident on a heavy supper of underdone pork-chops.

Sheet of Maps to Illustrate the Caroline Islands dispute between Germany and Spain. (London and Edinburgh: W. & A. K. Johnston. 1885.) Engraved with admirable clearness, this capital sheet of maps should be obtained by everybody interested in the question of the sovereignty of the Caroline Islands. Its value is greatly in excess of its moderate price.

We have also on our table, *The Kansas City Review, At Home Among the Atoms, The Child's Pictorial, Progress.* From the Messrs. Cassell: *Cassell's Household Guide, Cassell's Popular Gardening, Library of English Literature, The Countries of the World, Our Own Country, The Book of Health*, and *European Butterflies* (as beautiful as ever). *The Seventh Annual Report of the Dulwich College Scientific Society, India's Interest in the British Ballot-box, Howard Association Report, Oct.* 1, 1885, *The Sanitary News, Electricité, Le Franklin, Naturen, Religious Opinion*, and the *American Druggist.*

THE FACE OF THE SKY.

From Oct. 23 to Nov. 6.

By F.R.A.S.

The Sun may be watched as usual for spots and faculæ. The face of the night sky will be found delineated on Maps X. and XI. of "The Stars in their Seasons." Minima of Algol will occur on October 25 at 7h. 3m. p.m. Mercury is an evening star, but is in no legitimate sense visible—a remark which applies, *à fortiori*, to Venus with his tremendous south declination. Mars, as a small, red gibbous disc, may be seen over the eastern horizon now after midnight, but as his diameter is only between 6″ and 7″, of course no detail can be made out on his surface. Forming a triangle with Regulus and μ Leoni to-night, he passes between these stars and to the east of Regulus by the end of the fortnight. Jupiter and Uranus are still invisible. Saturn is nightly coming into a better position. He still forms a triangle with ϵ and ν Geminorum. Neptune must be sought in the place so repeatedly described here recently. The Moon is full to-night at 9h. 22·6m., and enters her last quarter at 5h. 57·8m. p.m. on the 30th. She will be new on November 6 at 9h. 2·7m. p.m. Two occultations will occur during our prescribed hours in the course of the next fortnight. On October 27, B.A.C. 1930, a star of the 6¼th magnitude, will disappear at the Moon's bright limb at midnight at an angle of 51° from her vertex. It will reappear at 1h. 6m. the next morning at the dark limb at an angle from her vertex of 249°. On the 29th, I Cancri a 6th magnitude star, will disappear at the Moon's bright limb at 10h. 5m. p.m., at a vertical angle of 115°; to reappear at her dark limb at 10 h. 26 m. at an angle of 164° from her vertex. When these notes begin the Moon is in Pisces, but at 4 o'clock this afternoon she passes into the north-west corner of Cetus. She quits this for Aries at 5 a.m. to-morrow, and remains in Aries until 8 a.m. on the 25th, when she crosses the boundary into Taurus. Travelling through the last-named constellation she arrives at 8 h. 30 m. p.m. on the 27th on the confines of the extreme northern projecting region of Orion. At 8 a.m. on the 28th she emerges from the other side of this in Gemini; whence, at 11 p.m. on the 29th, she passes into Cancer. At 11 a.m. on the 31st she quits Cancer for Leo, in her passage through which she descends at 9 p.m. on November 1st into Sextans; emerging however in Leo again at 1 o'clock the next morning. She finally leaves Leo for Virgo at 1 a.m. on the 3rd, and occupies until 3 h. 30 m. a.m. on the 6th in crossing the last-named constellation. Then she enters Libra, where we leave her.

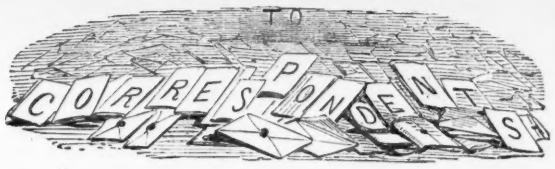
Miscellanea.

A copy of the new Library Map of the Colony of Victoria has been forwarded by the publisher, Mr. A. Johnston, of 6, Paternoster-buildings, E.C., to the Queen who has been pleased, we may reasonably assume, to accept the present.

Messrs. Bolckow, Vaughan, & Co., have come upon a thick bed of salt at their bore-hole near Eston Jetty, to the east of Middlesbrough. The salt was reached at a depth of 1,550 ft., and already 62 ft. have been pierced through without reaching the bottom of the bed.

Extensive fires have been wasting thousands of acres of wheat lands in Dakota. On many large farms all the buildings have been destroyed. These fires have raged during two weeks for hundreds of miles along the Northern Pacific Railway, from Brainard westward beyond Bismarck.

The Diamond Fields.—It appears that the production of the South African diamond fields in July was, in round figures, 170,000 carats, which realised £156,000, or 18s. 5d. per carat. In October, 1882, the production was 211,746 carats, which realised £355,315, or 33s. 7d. per carat. The reduction in the monthly production and the selling price has not, upon the whole, been so great as appears from this comparison, as the output has fluctuated a good deal from month to month; nevertheless, the general tendency of the selling price appears to be downwards, and the production has also been effected by serious falls of reef. It took the various diamond mines of the world two centuries, prior to 1870, to produce less diamonds than the Kimberley district has placed upon the markets during the last fifteen years. In view of this fact, and in view also of the gradual decline in the selling price, the conviction is forced upon us that the South African diamond fields have been permitted to produce too rapidly. The existing state of affairs is forcing amalgamation upon the various South African diamond mining companies; this may have the effect of decreasing the output, but it is believed that the diamond trade will ultimately be brought into a healthier condition by it.—*Engineering.*



"Let knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to, delays arise for which the Editor is not responsible.

The Editor is not responsible for the opinions of correspondents.

All Remittances, Cheques, and Post-Office Orders should be made payable to Messrs. Wyman & Sons.

No communications are answered by post, even though stamped and directed envelope be enclosed.

ARE PLANTS SENTIENT BEINGS?

[1954]—Many years ago I satisfied myself that trees were aware of the attraction of gravitation, and exhibited their knowledge by not growing at right angles to the ground on the hillside as they do on the plain.

The pandanus, which has a creeping stem, throws downwards buttress roots as supports, and, as a remarkable illustration, a banian growing on the edge of a gorge threw down great supporting roots to save itself from precipitation into the depth below.

Each of these plants must have been aware of the riskiness of its position, in taking steps to secure its safety.

Plants are aware of injuries to their structure, and take early steps to repair them. Gash any tree, and it will at once, but slowly, set about repairing the mischief. Gash the pandanus, and it will inevitably develop a root at the spot. I may here note a singular affinity in the reparation of injury between the pandanus and our common house-lizard, the gecko. The facility with which it drops its tail, and its unconcern at the loss, are well known; but not the strange fact I am about to describe. One day I noticed on the wall a lizard with two tails; drawing nigh, quietly, I saw that the new tail had been pushed out on the scar of an injury, and Fig. 1 shows the curious result. Apropos to tail-dropping, the new tail is always smaller than the old.

Fig. 1.

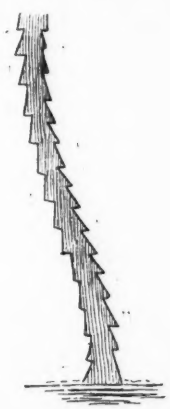


Fig. 2.

Let us return to the plants. The following fact shows that they must be endowed with something approaching sight or smell, or very exalted touch. Train a creeper up a three-foot pole, and let it run six inches above and throw out exploring tendrils; now erect another pole two inches beyond the possible reach of the tendril, and then mark how soon the new pole is seized; you will be astonished how soon the new support is recognised, and appropriated. What guided that plant?

Again, all plants are aware of the difference between darkness and light, and every one is familiar with the blanching effects of darkness upon vegetables; as also with the fact that plants in verandahs grow towards the light.

Further, plants are distinctly cognisant of pain; out here, the date-palm (*Phœnix dactylifera*), as soon as it rises three or four feet above the soil, has to undergo the cruel process of tapping for toddy; a huge triangular gash is made into the soft structure beneath the crown of leaves, which distinctly retreats from the wound; next year, the poor tree is tapped on the opposite side, beneath the year's growth, and it retreats helplessly to the opposite side, and thus, as it advances towards old age, its graceful stem is converted into a jagged zig-zag (Fig. 2).

This serration is entirely due to the poor plant edging away from the cruel knife. An equally familiar illustration of the sensibility of plants to pain or irritation is seen in the common sensitive plant (*Mimosa sensitiva*) which shrinks nervously from the faintest touch, or even breath.

Then there is the well-known irritability of Venus' fly-trap, associated with its alleged carnivorous tendencies. These are also attributed to the sticky and humble *Drosera*, or sun-dew.

That the capture of insects by both plants is simply accidental, and in no way contributory to their sustenance, is easily proved by keeping them under glass shades, where they are as vigorous as when at large in the hothouse.

All plants are, more or less, sensible to bad odours or irritant fumes, and in their presence the *Mimosa sensitiva* shuts up shop at once.

All plants are equally sensitive to hunger and thirst, and heat and cold; all breathe, and all sleep; some visibly, as in the closing leaf or flower.

I used to be told at school that trees at home shed their leaves on the approach of winter because the increasing cold drove inwards the sap, and the leaves thus deprived of their life-blood dropped off.

Against this theory may be urged the fact that, in India, trees cast their leaves at the commencement of the hot weather, when the tree is laden with sap. In my humble opinion, leaf-shedding is simply analogous to moulting among birds; perhaps also to skin-shedding among reptiles and larvæ. Some plants, of weak intellect, exhibit it in apparently senseless movements. The leaves of a plant in Bengal (I forget its name and am away from my books) are in eternal agitation; and we are all familiar with the shivering of the aspen.

The sexual and seed-distributing movements of plants are very wonderful, and clearly indicate design; a common plant out here produces seeds like a hawk's skull, and, in the place of the ears, are two sharp hooks, which ruthlessly attach themselves to any passer-by. The irritable seed-pods of certain plants—the balsam, for instance, are familiar to all gardeners, and are clearly indicative of design in widely distributing the seeds. Nay, there is as much design in the spear-grass, which sticks its barb into the trouser of a passer-by, as in the bot-fly, which deposits its egg within reach of the tongue of its victim; or in the cuckoo, which drops its egg in the nest of the hedge-sparrow.

All plants have periodic œstra, distinguished in some by regular discharges; some of the acacias discharge gum; the cannabis indica discharges its gum-resin in the shape of charas, a most intoxicating drug.

The babool (*Acacia Arabica*) not only discharges gum arabic, but also takes on a coloured discharge of liquid catechu. The neem tree discharges profusely at times, and the discharge is regarded as very "big medicine" by the natives.

Plants have distinct instinctive powers, as I have already hinted at. What can be more remarkable than the invariable twisting from left to right of climbing plants. Why do they act thus? I can't say, unless they are flung to the right by the revolving earth.

Self-preservation and propagation are surely sentient principles, and both depend on the marvellous inherent vitality of plants. I will defy anyone to kill outright two of our figs: the banian, and the peepal; history tells us of the prodigious and combined efforts to destroy John Barleycorn, notwithstanding which

> John Barleycorn came up again
> And sore surprised them all.

And so, with all our efforts to destroy these figs. Let me explain: the peepal produces small round red figs, in thousands, and when they are in season, all the frugivorous birds of the neighbourhood flock to the feast by day, and the flying foxes (great frugivorous bats) by night. This seems simple enough. But mark the wonderful working of nature for sowing the peepal broadcast over the land. Its little seeds are indigestible, and pass rapidly through bird and bat. Consequently, wherever the dropping falls, there the peepal rises. And this means a good deal, when it is borne in mind that the peepal is the iconoclast of India, its great function being the disintegration of rocks and buildings. As regards the latter, it is a fearful nuisance, and the keepers of our great buildings—the Taj, for instance—are constantly on the watch during fig-time for bird-droppings.

XUM

As an illustration of what can be done, as also of the marvellous inherent vitality of the peepal, note the following: on the summit of the northern minaret of the great mosque of Bareilly, 150 feet high, a peepal flourishes grandly beyond reach of man; oxygen it can get freely enough from the surrounding air, from whence also it can get moisture during the rains; but how during the burning west winds of March-May? it flourishes all the same, and its ever-active roots are gradually destroying the cupola of the minaret.

We can hardly give the humble potato much credit for sentiency, yet that humble tuber knows very well what it is about. At home the whole tuber is cut up for planting; out here it tells us:—"Give congenial soil, and you need only plant my eyes, retaining my body for your food."

I saw this exemplified at Darjiling, where potatoes flourish marvellously, and where I saw the peelings of my kitchen growing freely in the ditch into which they had been cast.

If this hint were taken at home, what an enormous saving of food there would be.

I trust that after the facts I have adduced, an answer in the affirmative will be conceded to the question at the head of my paper. R. F. HUTCHINSON, M.D.

Pachmari, Sept. 12, 1885.

THE PROCESS OF THE SUNS."

[1955]—In your editorial comment to my letter (1592) you write, "These stars, however, always 'go in' again. How about that?" Well! according to present notions, our sun, and all other suns, after being born, "coming out," and attaining their grand climacterics of activity will gradually decline and "go in" again. Now, may it not be possible that amongst the suns there may be *fast* suns as well as *slow* suns? May not there be prodigal suns, which rush to their culmination and as quickly disappear? May there not be, in fact, differences in the periods of the evolution and devolution of suns? And may not the Star in Andromeda be a fast star? I trust, sir, that both you and the readers of this journal will perfectly understand that I am merely offering speculative suggestions.—W. CAVE THOMAS.

[I do not say nay. As the Frenchman said to Dickens, many things are possible.—R. P.]

AUDEOGRAPHY.

[1956]—I thank you for your notice of my little book. But when you liken my system to "diagrams of seagulls in flight, flydirt on windows, and worms which have been trodden on," you condemn shorthand from its very initiation. I merely follow in the footsteps of my predecessors in the use of straight lines, curves, circles, semicircles, and quarter-circles; I only differ in the application of these stereotyped shorthand characters. DIGAMMA.

P.S.—I have not the pleasure of knowing Mr. J. Greevz Fisher or his writings. [Nor have I. Did not the reviewer, though, say just what you do about the application of his remark? I fancy I recall something of the sort. I have not seen your book.—R. P.]

TO GET THE FLESH OFF A MOUSE.

[1957]—Reply to "Nigel's" query, current number of KNOWLEDGE, p. 300. To get the flesh entirely off a mouse.—Having set him out in a good attitude, bury him very lightly beside an ant's nest. Beautiful preparations of small skeletons are made in this way. X.

HOW TRADESMEN CALCULATE PERCENTAGES.

[1958]—It appears to me that a brief criticism in KNOWLEDGE of the mode in which London tradesmen calculate their percentage of profit would have a salutary effect.

The following declaration of faith (so to speak) is that of an intelligent traveller for an important trading concern in London, and is supported by the opinion of one of the most extensive tradesmen in the metropolis. I give the statement word for word.

"If I purchase an article for 10s. and sell it for £100, I assert that I get a profit of 99½ per cent. exactly on the transaction."

I am informed that London tradesmen consider any other mode of calculating profits misleading. I will thank you for an authoritative expression of your views.

I enclose my card, but not for publication, and sign myself,

DER EWIGE JUDE.

[Emphatically—this is *not* a *method of calculation*, unless adding 2 to 2, and getting (say) 81, may be so regarded. The profit is of course not 99½, but 19,900 per cent.: a slight difference. What the tradesman really means, and wants to say, is that of his selling price, in such a case, 99½ per cent. is clear profit. But of course that is a very different thing from "the percentage of profit on the transaction."—R. P.]

LETTERS RECEIVED AND SHORT ANSWERS.

IRIS. The book is bosh—utter and irredeemable.—ROMEO. "Alas, you thought it could be trusted, but though you tightly tied it down, it busted" quotation is from *Punch*—very venerable, fine old crusted. It busted about the delicate neck of it, and no experiment could be made.—G. J. W. LOCK. Fear there is no space.—J. W. GREEN. We have been obliged to discontinue putting in any poetry; it gets so misunderstood. We cannot, for that reason, even give reasons.—CHEMICUS. Lockyer on Spectrum Analysis and Lockyer on Astronomy are different matters. He is reputed to be a chemist among astronomers. But I cannot answer for that point. You can safely try Roscoe's. Still I believe Lockyer's is sound.—B. On first question, I have no knowledge of such a work. On the second, I propose to answer that in the way you suggest as best. Thanks for pleasant letter.—F. W. H. Yes: but don't mention it. Even of the best of that sort, we can only say "They mean well; oh! they mean really very well: but——they don't know."—R. LEWINS. *Quien sabe?*—HALLYARDS. As I have said to others, so say I to you; I adapt my answers to those I am addressing. If you have seen answers that "made you wince," be sure I was responding to great rudeness. Your last letter singularly illustrates your callousness towards me: why should I be less callous towards you? Why should I suppose you will feel at all hurt if I answer in kind? That would be to attribute more wilful offence to you, than you have (I imagine) been guilty of. I have politely assumed that it is because a little plain speaking does not hurt you that you are so very free with it towards me. For instance, in your letter of four short pages, quite up to your usual average of courtesy, you tell me in the first page that I say the thing that is not. (Thus satisfying yourself that I am very ignorant.) And again you charge me with untruth (about your comparative ebriety letter) in the second page; on the second page, also, you sneer at my work as editor, and call me in effect a bad man of business; on the third page you call me a sophist and a savage: on the fourth page you call me a bear, and even provide an epigram for me (you say you "have made" it, but that must be a slip of the pen considering the antiquity of most of it) as follows:—

Quâ locus, Erigonen inter, Chelasque sequentes
Cæsaris, eu! functi numina fixa polo:
Quâque micant Ursæ, metuentes æquore tingi,
Astrologus Cæsar Maximus Ursus erit.

Adding such "praise to the face" as—known to be unmerited—is assuredly "open disgrace." If I take all this as "banter," you should take my replies in kind.—(I win the brass farthing, by the way.)—I wrote *patientia* (uncircumflexed, as usual), and I wrote *abuti;* but every one knows the original passage, and I suppose a "printers' reader" who knew it thought there was something wrong, and altered *abuti* to *abutere* as in the original passage, and the *supposed* nominative into an accusative. I ought perhaps to say that I *certainly* meant to write *abuti*, and *to the best of my belief* did so write the word; but after the tricks I have known the mind play (me and others) I could not be absolutely sure that I wrote what I meant to write. (This very moment I wrote *abutere*, where, just above, I intended to write *abuti*.) As for the *patientiam*, I am satisfied I did *not* write that, because there was nothing to lead the mind to such a mistake. Most likely the absence of the circumflex led the "reader" to correct what he thought an error. A look at the MS. might explain—some mark looking like an "m" and belonging to another line, might have deceived the compositor or the reader. You are probably not aware that "readers" often suggest corrections (in French this repeatedly happens), and where notes like my replies, hurriedly jotted down in pencil (nine-tenths written in express trains as well as at express speed), and set up usually without my seeing proofs, are in question, a "reader" would not hesitate to correct to the best of his judgment what seemed wrong, especially if the writing were not easily decipherable. No one *could* do what you, "an experienced examiner," attribute to me. How on earth could the verb be infinitive in the sentence—"Quo usque tandem abutere, Catilina, patientia nostra"? followed as nearly as I can recall the words by "quam diu nos etiam furor iste tuus *eludet?* quem ad finem sese effrenata *jactabit* audacia?" One might as reasonably find an infinitive in the familiar . . . . *si non, his utere mecum* (though following the imperative *imperti:* of course here the quantity shows that the word is imperative, not future indicative. If you could not credit me with a schoolboy's knowledge of Latin, of the "Fungor, fruor, utor, vescor," &c., rule, of Cicero's fondness for the termination in *re*, and like details ("worth a pignut," anyway) you might at least give me credit for some small modicum of common sense. Surely you have shown here "the savage desire to make me contemptible," &c., which you attribute to me,—a perfect lamb, Mr. Wolf!—The answer which shocked you so related to manners, not to morals. A man applies to a woman in these columns the grossest term one can well think of (not actually using the word, but sending readers to "Othello" to find and apply it, which was rather worse), and

because I am indignant, you talk about Antinomian principles, and I know not what. I did well to be angry. (My anger was purely on principle; for personally I did not care two straws about the matter.) As for weekly KNOWLEDGE, and your idea that it does not (or rather did not) pay, it certainly did not pay me—nothing would, I think—for the worry and annoyance of the Replies Column, or even for the work involved. I value at about ten pounds weekly the time given to this. Do you suppose it paid me at that rate!—P. J. BEVERIDGE. No: no offence, but wasting time. I certainly understood your use of the word "infinitesimal" to mean (as mathematicians use it) something indefinitely small. Nothing "virulent or insolent" in your remark about my supposed mistake; you tried my *patientiam* only in the sense of trying the *word*, not my patience. What an odd mistake your idea that I referred to *you* when in replying to "Hallyards" I spoke of a "reader" ("inverted" to show I meant the word in its technical sense), going to look up the passage in question. I meant, of course, the "printer's reader." When I was quite a little chap I knew that oration by heart—and I know it pretty well by heart now, but a minute or two ago I found myself in doubt about "nos" in the second sentence. I remember I learned it so young that, being by myself, with no one to tell me how to pronounce, I got a number of pronunciations wrong, including the first words, which I read Quowsqwy (almost rhyming with "house key") greatly to the astonishment of the master who first heard me say it—when I was about 12, and ought to have known better. (In like manner, even to this day, if I say off the letters of the Greek alphabet without attending—as people repeat the Creed and the Lord's Prayer—I always finish off, Fy, *Tchy*, Psy, Omega: if "Hallyards" heard me say that, he would be sure that I pronounced Achilles, *Atchilles;* but I don't. I have a son who in like manner learned to recite the Creed with this remarkable emendation,—"Suffered under Punch's spider," and would say it so now if not attending. A valued contributor to these pages learned, in his catechism, about "the sea and all the Tinthummies," forming vague ideas (like Pip about "jiggering" and De Morgan about "vicktchuals") as to the nature of these presumably pelagic creatures. Of course "utor" without "ab" governs the ablative. I have a vague recollection of the rule about this, in that preposterous work the Eton Latin Grammar, coming soon after one of the few rules I recall of all that rubbish, to wit, *Dativum ferme regunt* [don't they] *verba composita cum his adverbiis, bene, satis, male* [as "*Dii tibi malefaciant*"—a cheerful thing to teach a boy to say] *et cum his præpositionibus* [almost as nice as "Mesopotamia"] *præ, ad, con, sub, ante, post, ob, in, inter.* I wonder whether anything half so idotic as teaching boys this (instead of teaching them to read and speak Latin and so to find out those rules) goes on at any of our schools now. I can read my Horace or my Terence; but I assuredly did not learn to understand Latin or enjoy reading it, at school, or at college either: and I anathematise in my inmost soul, the idiots who devised the Eton Grammar method (there's madness in the method). Here endeth the Replies Column.

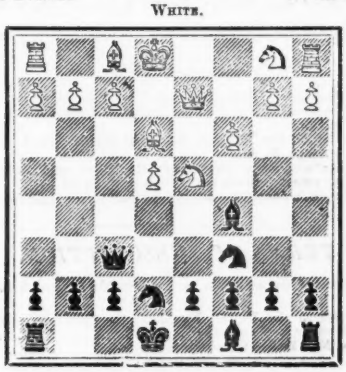
Our Chess Column.

BY MEPHISTO.

Dublin, *Oct.* 5.

DEAR SIR,—I have studied with interest your games, &c., on the Scotch Gambit Opening, in which White plays 7. Q to Q2. As you are desirous of having some games on the subject, I send the opening of a few of my own, also of two played between the Rev. G. A. McDonnell and Mr. Jas. Alex. Rynd, during the visit of the former to Dublin. W. H. S. MONCK.

WHITE.



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White. Mr. G. North.	Black. Mr. Monck.
7.	P to Q4
8. Kt to Kt5	B × B
9. Q × B	Castles
10. Kt × P	P to Q5
11. P × P	Kt × P
12. B to Q3	Q to QKt3
13. Castles	Kt to B6 (ch)
14. Q × Kt	Q × Kt

I do not think that Black has sufficient compensation for the P, though I won the game ultimately.

White. Mr. Monck.	Black. Mr. T. Pierce.
7.	B × Kt
8. P × B	P to Q4
9. Kt to B3	B to K3
10. B to QKt5 (B to Q3 seems better)	Q to Kt3
11. B × Kt (ch) (an unsound combination)	Kt × B
12. P × P	B × P?
13. Kt × B	Q × P
14. Kt × P (ch)	K to Q2
15. Castles	K × Kt
16. B to B4 (ch)	K to Kt3?

17. P to Q5 winning Kt with Q, for White threatens to check at K3, and then play one of the Rooks to KKt sq.

White. Mr. Rynd.	Black. Mr. McDonnell.
7.	Castles
8. Kt to Kt5	B × B
9. Q × B (White can also play P × B here with good effect)	P to Q4
10. Kt × P	R to Kt sq.
11. P × P	Kt to B4
12. Q to KB4	P to KKt4
13. Q to K4	B to Q2
14. Q to B2 (If 14. P × Kt, B × P, Black would soon regain the piece with a good attack.)	Q to K4 (ch)
15. B to K2	QKt to K2
16. Kt to R3	Q × Kt

Here, I think, Black has the advantage, but White (?) won.

White. Mr. Rynd.	Black. Mr. McDonnell.
7.	Q to Kt3
8. P to B3!	Castles
9. B to Q3	Kt to K4
10. Castles	P to Q4
11. Kt to R3	B to R6!
12. R to B2	QR to Q sq.
13. QR to Q sq.	B × KKt
14. P × B	B × P!
15. R × B	Kt × P (ch)
16. K to R sq.	Kt × Q
17. R × Q	BP × R
18. R × Kt	R to B6

I prefer Black, but White won.

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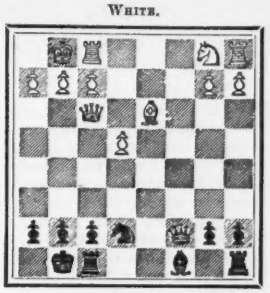

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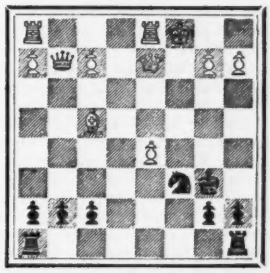

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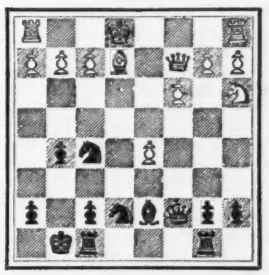

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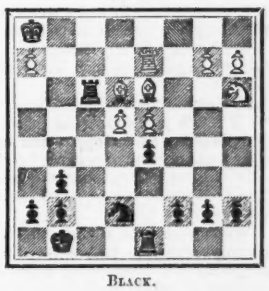

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We are much obliged to Mr. Monck for the above games, and hope to continue our investigations in that direction.

KNOWLEDGE BACK NUMBERS.—The following are out of print, viz.:—Nos. 1 to 13, 16, 17, 20, 21, 22, 23, 26, 27, 28, 29, 31, 32, 33, 34, 36, 49, 50, 51, 53, 60, 62, 63, 79. All other numbers are to be had on application to the publisher, price 3½d. post free. Vols. I. and II. are entirely out of print; so also is the Index to Vol. I. The prices of the volumes for sale are as follows:—Vols. III. and IV. (Jan. to Dec., 1883), 7s. 6d. each; Vols. V., VI., and VII. (Jan., 1884, to June, 1885), 9s. each. Vol. VIII. (nearly ready), July 3 to Oct. 16, 1885, 7s.

XUM

Our Whist Column.

By "Five of Clubs."*

We come next to the painful subject of the revoke. This, so far as my observation has extended, is a commoner fault in club play than in home play: probably because in the kind of Home Whist which I wish to promote, there is a love of the game which renders revoking almost impossible. Among club players there are always some who are no real lovers of Whist, but chiefly love to play because of the excitement which the chances of the game afford. Of course, in club play, the penalty for the revoke—three tricks to be taken from the score of the revoking side, or added to the score of the other side, or to be partly taken from the former and partly added to the latter—is remorselessly exacted. But in Home Whist the case is different. Here, if the revoke can be corrected (the penalty is due, be it remembered, when the revoking trick has been turned and quitted), without harm to either side, this should be done. If the revoke, though it can be corrected, has affected the strategy of the game, then the other side may properly claim the right to call the cards played in error, or to call a suit. But if, as often happens, the revoke is detected too late for correction, and it is impossible to determine what its actual effect may have been, it is a good plan to deal thus with the score (which, as will presently be shown, is to be kept systematically in Home Whist):—Subtract three from the score of the revoking player, and one from the score of his partner. This puts the chief loss on the revoker, but properly inflicts a loss on his partner, because in most cases a trick is gained wrongfully by a revoke. Sometimes, of course, more than a trick is gained, and sometimes nothing; but what amounts in effect to a gain of two by each of the non-revokers, met by a loss of three by the actual revoker, and of one by his partner, is a very fair average compensation for the effects of a revoke.

Lastly, so far as the Whist code is concerned, let home players, if they wish to play a decent game, and avoid an annoying and mischievous practice, give up the privilege accorded by Law 91, that a player may demand to see the last trick turned, at any time before the current trick is turned and quitted. Let players of Home Whist determine that if, through inattention, they find themselves unable to remember the cards which fell to the last tricks, they will put up with the consequences, and play more carefully in future.

A few words here on the etiquette of Whist, which I regard as more important than even the laws, in the home game. Nothing more distinctly marks the true lover of the noble game of Whist than the care with which he avoids anything which can give his partner intimations not derivable from the actual progress of the play, and anything by which the adversaries may be wrongfully misled. The offences to be specially avoided are these:—

1. Looking gloomily at a bad hand, or the reverse.
2. Smiling complacently over a good one, or the reverse.
3. Expressing disapproval when partner does not lead as you wish.
4. Expressing approval when he does.
5. Pretending to hesitate when you have but one card you can play, or when you can have no doubt as to your play.
6. Showing by any movement that you know how a trick must fall, when you can only know this because you hold a particular card or cards.
7. Showing by any movement that your partner need not take a trick which you know (but he may not know) to be yours.
8. Looking at the opponents' cards.
9. Letting your own cards be visible.
10. Forgetting, or acting as if you had forgotten, that Whist is a game intended for relaxation and diversion.

With regard to the method of playing, I would make the following remarks:—It is well to keep a score, not for each evening's play only, but running on from day to day; and in this score the number of points made by each player should be entered, as also the number of revokes, exposed cards, and other like delinquencies: such a record has the effect of keeping the play strict and methodical, without the degrading tendencies which money stakes, however small, necessarily have. It it well to count only half honours in home play,—that is, one instead of two for three honours, and two instead of four for all the honours. Omitting to count honours at all eliminates still more the chance element, and is in my opinion better yet, considered by itself. But as players have often to be met who count honours, it is necessary to keep in the way of noting them: and in the long run the influence of chance in this matter equalises itself. For a similar reason, it is well to play for rubbers in the usual way—that is, counting a game made before the enemy has scored as three, before they have scored more than two as two, and when they have scored three or four as one, the rubber (or best of three games) counting as two. The system is absurd enough, doubtless, since the winners of the rubber may have scored fewer on two games than the losers on one. The Chilian system described in "How to Play Whist" is a far better one. But as you have often to play with those who know no other system than the club system—essentially a gambling one—it is as well to adopt it for home play. The undue effects of the rubber points are equal for all in the long run; moreover, pretty points of play often arise out of this method of scoring. (Note that tricks count before honours, so that if one side hold all four honours and would go out with them, but their adversaries go out in tricks, the honours are not counted at all; whereas, if one side go out in honours, and the other side, though not going out in tricks, make one or more, these must be counted, in determining whether a game is to be regarded as a single, a double, or a treble.

Lastly, be it noticed that when the full number of players cannot be brought together, single dummy is an excellent card game for three, and double dummy a capital game for two. Both games are slow and wearisome in the extreme when played, as they too often are, without attention to the principles of Whist strategy. But they are most interesting when played properly. Nothing tends more to improve the Whist-player than an occasional turn at dummy Whist.

* From the forthcoming little work on "Home Whist," by Richard A. Proctor.

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